A.11 Giant Garter Snake (*Thamnophis gigas*)

A.11.1 Legal Status

The giant garter snake (*Thamnophis gigas*) is a state and federally threatened species. The State of California listed the giant garter snake as threatened on June 27, 1971 (DFG 2008). The U.S. Fish and Wildlife Service listed the species as federally threatened on October 20, 1993 (58 FR 54053).

The Draft Recovery Plan for the Giant Garter Snake (*Thamnopsis gigas*) was completed in 1999 (USFWS 1999).

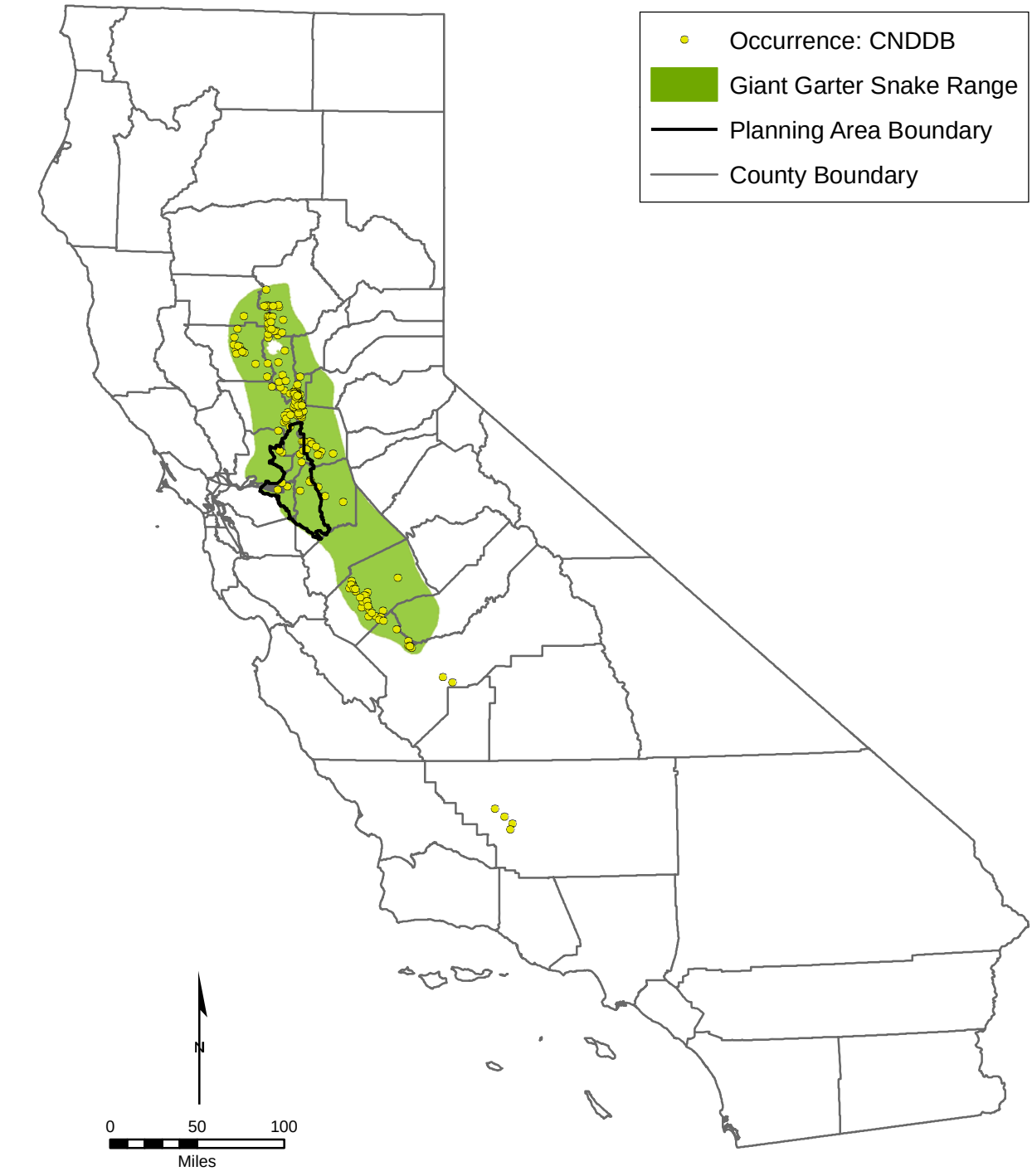
Critical habitat has not been designated for this species.

A.11.2 Species Distribution and Status

Range and Status

The giant garter snake is endemic to wetlands in the Sacramento and San Joaquin Valleys and was historically distributed throughout the San Joaquin Valley (Hansen and Brode 1980). The current distribution extends from near Chico in Butte County south to the Mendota Wildlife Area in Fresno County (Figure A.11.1). No occurrences of giant garter snakes are known from the northern portion of the San Joaquin Valley north to the eastern fringe of the Sacramento-San Joaquin River Delta, where the floodplain of the San Joaquin River is limited to a relatively narrow trough (Hansen and Brode 1980, 58 FR 54053). The resulting gap of approximately 100 kilometers (62.3 miles) separates the southern and northern populations, with no giant garter snakes known from the lowland regions of Stanislaus County (Hansen and Brode 1980, CNDDB 2008). Scattered records within the Sacramento-San Joaquin River Delta suggest that giant garter snakes may have occupied this region at one time, but longstanding reclamation of wetlands for intense agricultural applications has eliminated most suitable habitat (Hansen 1986, CNDDB 2008). Recent records within the Sacramento-San Joaquin Delta are haphazard, and repeated surveys have failed to identify any extant population clusters in the region (Hansen 1986, Patterson and Hansen 2002, Patterson 2003).

Occurrence records indicate that garter snakes are currently distributed in 13 unique population clusters coinciding with historical flood basins, marshes, wetlands, and tributary streams of the Central Valley (Hansen and Brode 1980, Brode and Hansen 1992, USFWS 1999). These populations are isolated, without protected dispersal corridors to other adjacent populations, and are threatened by land use practices and other human activities, including development of wetland and suitable agricultural habitats. The USFWS recognizes these 13 extant populations (58 FR 54053), including Butte Basin, Colusa Basin, Sutter Basin, American Basin, Yolo Basin-Willow Slough, Yolo Basin-Liberty Farms, Sacramento Basin, Badger Creek-Willow Creek, Caldoni Marsh, East Stockton Diverting Canal and Duck Creek, North and South Grassland, Mendota, and Burrel-Lanare. These populations extend from Fresno north to Chico and encompass 11 counties: Butte, Colusa, Glenn, Fresno, Merced, Sacramento, San Joaquin, Solano, Stanislaus, Sutter, and Yolo.



Source: California Department of Fish and Game, WHR, 2006.
California Department of Fish and Game, CNDDB, 2008.

Figure A.11.1. Giant Garter Snake Statewide Range and Recorded Occurrences

Distribution and Status in the Planning Area

There are 15 recorded giant garter snake occurrences sparsely distributed north of State Route 4 in the central and northern Delta portions of the BDCP Planning Area (Figure A.11.2) (CNDDB 2008). Four are west of the Sacramento Deep Water Ship Channel in the wetlands and pasturelands of the Yolo Basin; five are from the cultivated and remnant grassland areas east of the Sacramento River north of Walnut Grove; three are from the vicinity of White Slough south of State Route 12 and west of Interstate 5; and four are in the Central Delta, including two reported from the vicinity of Sherman Island. With the exception of recent detections made from the Yolo Basin, most of these records are from the mid-1980s (CNDDB 2008). There are no records south of State Route 4. While recent findings demonstrate that giant garter snake is extant in the Yolo Basin (Hansen 2007, Wylie et al. 2003, 2004, Wylie and Amarello 2006, CNDDB 2008), and potentially in other areas within the BDCP Planning Area, repeated attempts to assess local distribution have not been successful. There is concern that these isolated populations could be near extirpation (Hansen 1986).

A.11.3 Habitat Requirements and Special Conditions

The giant garter snake resides in marshes, ponds, sloughs, small lakes, low gradient streams, and other waterways, and in agricultural wetlands, including irrigation and drainage canals, rice fields, and the adjacent uplands (58 FR 54053). Habitat requirements include: 1) adequate water during the snake's active season (early-spring through mid-fall) to provide food and cover; 2) emergent, herbaceous wetland vegetation, such as cattails (*Typha* spp.) and bulrushes (*Scirpus* spp.), accompanied by vegetated banks for escape cover and foraging habitat during the active season; 3) basking habitat of grassy banks and openings in waterside vegetation; and 4) higher elevation uplands for cover and refuge from flood waters during the snake's dormant season in the winter (Hansen and Brode 1980, Hansen 1998, USFWS 2006a). In some rice-growing areas, giant garter snakes have adapted well to vegetated, artificial waterways and associated rice fields (Hansen and Brode 1993). The giant garter snake resides in small mammal burrows and soil crevices located above prevailing flood elevations throughout its winter dormancy period (USFWS 2006a). Burrows are typically located in sunny exposures along south and west facing slopes.

Due to lack of habitat and emergent vegetative cover, giant garter snakes generally are not present in larger rivers and wetlands with sand, gravel, or rock substrates. In addition, the major rivers have been highly channelized, removing oxbows and backwater areas that probably at one time provided suitable habitat. Riparian woodlands can provide suitable habitat but it is not likely because most have excessive shade, lack of basking sites, and absence of prey populations. Giant garter snake is also usually absent from most permanent waters that support established populations of predatory game fishes and from sites that undergo routine dredging, mechanical or chemical weed control, or compaction of bank soils (Hansen and Brode 1980, Rossman and Stewart 1987, Brode 1988, USFWS 1999, 2006a).

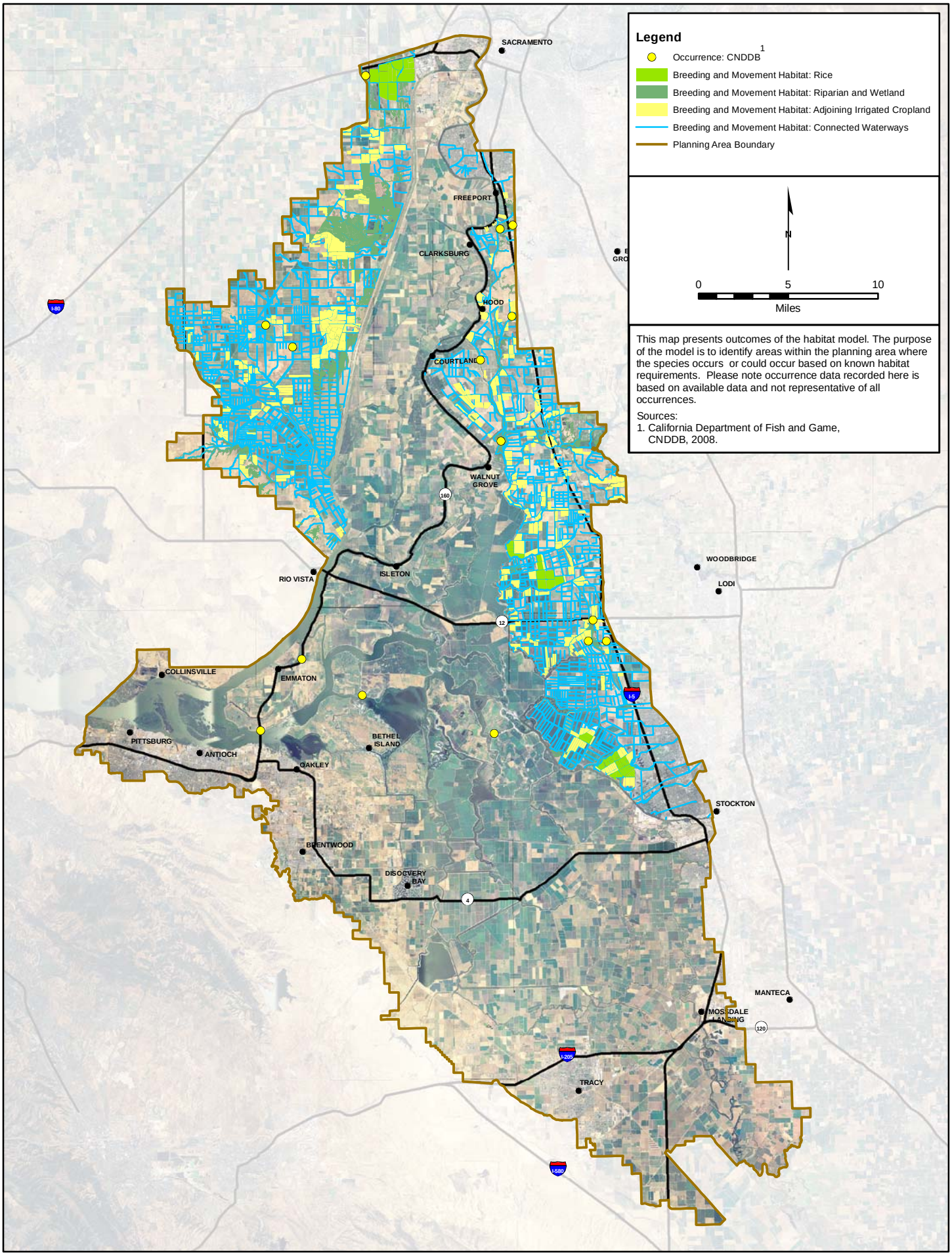


Figure A.11.2. Giant Garter Snake Habitat Model and Recorded Occurrences

Changing agricultural regimes, development, and other shifts in land use create an ever-changing mosaic of available habitat. Giant garter snakes move around in response to these changes in order to find suitable sources of food, cover, and prey. Connectivity between regions is therefore extremely important for providing access to available habitat and for genetic interchange. In an agricultural setting, giant garter snakes rely largely upon the interconnected network of canals and ditches that provide irrigation and drainage to provide this connectivity.

In the Central Valley, rice fields have become important habitat for giant garter snakes. Irrigation water typically enters the rice lands during April along canals and ditches. Giant garter snakes use these canals and their banks as permanent habitat for both spring and summer active behavior and winter hibernation. Where these canals are not regularly maintained, lush aquatic, emergent, and streamside vegetation develops prior to the spring emergence of giant garter snakes. This vegetation, in combination with cracks and holes in the soil, provides much needed shelter and cover during spring emergence and throughout the remainder of the summer active period.

Rice is planted during spring, after the winter fallow fields have been cultivated and flooded with several inches of standing water. In some cases, giant garter snakes move from the canals and ditches into these rice fields soon after the rice plants emerge above the water's surface, and they continue to use the fields until the water is drained during late summer or fall (Hansen and Brode 1993). It appears that the majority of giant garter snakes move back into the canals and ditches as the rice fields are drained; although a few may overwinter in the fallow fields, where they hibernate within burrows in the small berms separating the rice checks (Hansen 1998).

While within the rice fields, the snakes forage in the shallow warm water for small fish and the tadpoles of bullfrogs and treefrogs. For shelter and basking sites, giant garter snakes utilize the rice plants, vegetated berms dividing the rice checks, and vegetated field margins. Gravid (pregnant) females may be observed within the rice fields during summer, and at least some giant garter snakes are born there (Hansen and Brode 1993, Hansen 1998).

Water is drained from the fields during late summer or fall by a network of drainage ditches. These ditches are sometimes routed alongside irrigation canals and are often separated from the irrigation canals by narrow vegetated berms that may provide additional shelter. Remnants of old sloughs also may remain within rice-growing regions, where they serve as drains or irrigation canals. Giant garter snakes may use vegetated portions along any of these waterways as permanent habitat. Studies indicate that despite the presence of ditches or drains, giant garter snakes will generally abandon aquatic habitat that is not accompanied by adjacent shallow-water wetlands (Wylie and Amarello 2006, Hansen 2007, Jones and Stokes 2008), underscoring the important role that this crop plays in this species' life history.

A.11.4 Life History

Description. Giant garter snakes are one of the largest snakes in the genus *Thamnophis*. A sexually dimorphic species, females can reach sizes in excess of 3.3 feet and 1.87 pounds, while proportionally smaller males seldom exceed 0.55 lb. Giant garter snakes possess a dark brown or olive background color separated by light-colored longitudinal stripes. For this species, coloration is geographically and individually variable. Snakes from the San Joaquin Valley region may exhibit a black-checkered pattern along the back and sides, and often lack a distinct dorsal stripe; while snakes from the Sacramento Valley region are typically darker, with a complete dorsal stripe that varies from bright yellow to orange or dull brown.

Activity. Spending cool winter months in dormancy or periods of reduced activity, giant garter snakes typically emerge from late March to early April and remain active through October; the timing of annual activity is subject to varying seasonal weather conditions. Daily activity consists of emerging from burrows after sunrise, basking to warm bodies to active temperatures, and foraging or courting for the remainder of the day (Hansen and Brode 1993). Activity generally peaks during spring emergence and courtship from April into June, whereupon observations of giant garter snakes diminish significantly until a second peak is observed after females give birth during late July into August (Hansen and Brode 1993, Wylie et al. 1997, USFWS 1999, Hansen 2004). Giant garter snakes then remain actively foraging and occasionally courting until the onset of cooler fall temperatures.

Giant garter snakes are strongly associated with aquatic habitats, typically overwintering in burrows and crevices near active season foraging habitat (Hansen 2004. Individuals have been noted using burrows as far as 164 feet from marsh edges during the active season, and retreating as far as 820 feet from the edge of wetland habitats while overwintering, presumably to reach hibernacula above the annual high water mark (Hansen 1986, Wylie et al. 1997, USFWS 1999).

Reproduction. Upon emerging from overwintering sites, male giant garter snakes immediately disperse in search of mates and continue breeding from March into early May. Female giant garter snakes brood young internally, giving birth to live young from late July through early September (Hansen and Hansen 1990). Brood size ranges from 10 to 46 young, with a mean of 23.1 (n = 19) (Hansen and Hansen 1990). Young immediately disperse and seek shelter to absorb their yolk sacs, after which they molt and begin feeding on their own. Averaging 0.11 to 0.18 ounces with a snout-to-vent length of approximately 8.1 inches, young giant garter snakes will double their size within their first year (Hansen and Hansen 1990, USFWS 1999). Sexual maturity probably averages 3 years in males and 5 years in females (USFWS 1999).

Home Range. Data based on radiotelemetry studies show that home range varies by location, with median home range estimates varying between 23 acres (range [10.3 to 203 ac], n = 8) in a semi-native perennial marsh system and 131 acres (range [3.2 to 2,792 ac], n = 29) in a managed refuge (USFWS 1999).

Foraging Behavior and Diet. Giant garter snakes feed on small fishes, tadpoles, and small frogs (USFWS 1999), specializing in ambushing prey underwater (Brode 1988). Historically, giant garter snakes preyed on native species such as the thick-tailed chub (*Gila crassicauda*) and California red-legged frog (*Rana aurora draytonii*) (which have been extirpated from the giant garter snake's current range), as well as the pacific treefrog (*Pseudacris regilla*) and Sacramento blackfish (*Orthodox microlepidus*) (Cunningham 1959, Rossman et al. 1996, USFWS 1999). Giant garter snakes now utilize introduced species, such as small bullfrogs (*Rana catesbeiana*) and their larvae, carp (*Cyprinus carpio),* and mosquitofish (*Gambusia affinis*). While juveniles probably consume insects and other small invertebrates, giant garter snakes are not known to consume larger terrestrial prey such as small mammals or birds.

A.11.5 Threats and Stressors

Habitat loss and fragmentation, flood control activities, changes in agricultural and land management practices, predation from introduced species, parasites, and water pollution are the main causes for the decline of this species.

Habitat Loss and Fragmentation. Continued loss of wetland or other suitable habitat resulting from agricultural and urban development constitutes the greatest threat to this species' survival.

Conversion of Central Valley wetlands for agriculture and urban uses has resulted in the loss of as much as 95 percent of historical habitat for the giant garter snake (Wylie et al. 1997). In areas where the giant garter snake has adapted to agriculture, maintenance activities such as vegetation and rodent control, bankside grading or dredging, and discharge of contaminates, threaten their survival (Hansen and Brode 1980, Hansen and Brode 1993, USFWS 1999, Wylie et al. 2004). In developed areas, threats of vehicular mortality also are increased. Paved roads likely have a higher rate of mortalities than dirt or gravel roads due to increased traffic and traveling speeds, and as many as 31 giant garter snake traffic mortalities have been reported during a 4-year period in the Natomas Basin (Hansen and Brode 1993).

The loss of wetland habitat is compounded by elimination or compaction of adjacent upland and associated bankside vegetative cover, as well as water fouling; these conditions are often associated with cattle grazing (Thelander 1994). While cattle grazing and irrigated pastures may provide the summer water that giant garter snakes require, high stocking rates may degrade habitat by removing protective plant cover and underground and aquatic retreats such as rodent and crayfish burrows (Hansen 1986, USFWS 1999). Studies of wandering garter snakes (*Thamnophis elegans vagrans*) in northern California have shown population numbers to be much higher in areas where grazing was excluded (Szaro et al. 1985). Radiotelemetry studies in perennial wetlands where grazing was differentially excluded show that giant garter snakes avoid areas where grazing is frequent (Hansen 2002). However, cattle grazing may provide an important function in controlling invasive vegetation that can compromise the overall value of wetland habitat (Hansen 2002).

Predation. Giant garter snakes are also threatened by the introduction of exotic species. Examinations of gut contents confirm that introduced bullfrogs (*Rana catesbeiana*) prey on juvenile giant garter snakes throughout their range (Treanor 1983, Dickert 2003, Wylie et al. 2003). While the extent of this predation and its effect on population recruitment is poorly understood, estimates based on preliminary data from a study conducted at Colusa National Wildlife Refuge suggests that 22 percent of neonate (newborn) giant garter snakes succumb to bullfrog predation (Wylie et al. 2003). Other studies of bullfrog predation on snakes have documented bullfrogs ingesting other species of garter snakes up to 31.5 inches long, resulting in a depletion of this age-class within the population (Bury and Wheelan 1984). Introduced predatory game fishes, such as black bass (*Micropterus* spp.), sunfish (*Lepomis* spp.), and channel catfish (*Ictalurus* spp.), prey on giant garter snakes and compete with them for smaller prey (58 FR 54053).

Large vertebrates, including raccoons (*Procyon lotor*), striped skunks (*Mephitis mephitis*), red foxes (*Vulpes vulpes*), gray foxes (*Urocyon cinereoargentius*), river otters (*Lutra canadensis*), opossums (*Didelphis virginiana*), harriers (*Circus cyaneus*), hawks (*Buteo* spp.), herons (*Ardea herodius*, *Nycticorax nyctycorax*), egrets (*Ardea alba*, *Egretta thula*), and American bitterns (*Botaurus lentiginosus*) also prey on giant garter snakes (USFWS 1999). In areas near urban development, giant garter snakes may also fall prey to domestic or feral house cats. In permanent waterways, introduced predatory game fishes, such as bass (*Micropterus* spp.), sunfish (*Lepomis* spp.), and channel catfish (*Ictalurus* spp.), prey on giant garter snakes and compete with them for smaller prey (58 FR 54053, Hansen 1998).

Water Pollution. Selenium contamination and impaired water quality have been identified as a threat to giant garter snakes, particularly in the southern portion of their range (USFWS 1999). While little data are available regarding the effects of specific contaminants, the bioaccumulative properties of selenium in the food web has been well documented in the Kesterson National

Wildlife Refuge area (Ohlendorf et al. 1988, Saiki and May 1988, Saiki et al. 1991, USFWS 1999).

A.11.6 Relevant Conservation Efforts

Conservation efforts for the giant garter snake have included restoration efforts on wildlife refuges and through mitigation banking. With the continued loss of habitat within the range of the species, the snake has become increasingly dependent on ten refuges and wildlife management areas in the Central Valley (Czech 2006).

Hundreds of acres in the California refuge system are known to be occupied by the snake, however thousands of acres of apparently suitable habitat in the refuge system are currently unoccupied (Czech 2006). This suggests that factors such as winter flooding and predation (especially by non-native species such as bullfrogs) may be limiting in some areas. The giant garter snake prefers summer flooding and winter drying and Central Valley refuges system properties are likely managed intensively for wintering waterfowl with a reversed water regime, resulting in habitat features that are problematic for giant garter snake conservation. These opposing requirements suggest that separate conservation areas for the snake are necessary. In 1995, the Colusa National Wildlife Refuge acquired 449 acres of fallow rice fields and efforts to restore the ecological integrity have proven beneficial to the snake (Czech 2006).

Some mitigation banks are also designed specifically for giant garter snake habitat preservation and restoration, including the 565 acre Gilsizer Slough South Giant Garter Snake Conservation Bank in Sutter County, and the 424 acre Sutter Basin Conservation Bank.

Other wetland conservation efforts can also prove beneficial to giant garter snake under appropriate management regimes. Central Valley wetland conservation occurs through a combination of both public and privately managed refuges, mitigation banks, and duck clubs, creating a large network of wetland preserves throughout the historical range of the giant garter snake. A large percentage of these wetland conservation efforts, however, are geared toward waterfowl management, often placing greater emphasis on winter water rather than the summer water upon which giant garter snakes depend (USFWS 1999). With proper consideration given to design, location, and management, these efforts might also significantly benefit the giant garter snake and other wetland-dependent species (USFWS 1999).

The CALFED ERP's Multi-Species Conservation Strategy designates the giant garter snake as "Contribute to Recovery" (CALFED Bay-Delta Program 2000). This means that CALFED will undertake actions under its control and within its scope that are necessary to recover the species. Recovery is equivalent to the requirements of delisting a species under federal and State ESAs. The Ecosystem Restoration Program has funded several projects designed to supplement current knowledge of giant garter snake populations and habitat use. Two projects were recently funded that contain actions that benefit giant garter snake through ongoing monitoring of semi-permanent wetlands, rice-cover crop rotation fields, and waterways adjacent to agriculture lands. Another project will evaluate the effects of fallowing agricultural habitat on giant garter snake by monitoring habitat use under normal rice growing conditions and comparing results with analogous data from those same fields and adjacent irrigation ditches after fallowing. This project will also monitor habitat use on wetland restoration sites and assesses population demographics and viability of the giant garter snake. Study areas for all three projects include Barker Slough and Hastings Cut in Yolo County, Gilsizer Slough in Sutter County, areas within Richvale Water District in Butte County, and various other rice fields and managed wetlands in

Butte County. These coordinated ERP projects began work in 2007 and are in the initial stages of data collection. They are designed to provide information that will help guide future restoration and conservation activities as they pertain to managing rice farms and surrounding natural habitats for the giant garter snake. Continuing project activities include ongoing telemetry of radio-marked snakes to evaluate habitat use and behavior, and trapping of snakes to develop mark/recapture estimates. Results from these projects will support filling in some of the research data gaps for the giant garter snake including determination of optimal habitat, effects of cropping patterns and specific agricultural practices on movement patterns and viability, value of restored habitats, and species status and distribution. Additionally, results from these research projects will directly facilitate future revisions of the conservation measures within this strategy.

In addition, the ERP implementing agencies have facilitated the development and preparation of the draft Sacramento Valley Giant Garter Snake Conservation Strategy.

A.11.7 Species Habitat Suitability Model

Breeding and Movement Habitat: Breeding and movement habitat for the giant garter snake includes the following land cover types and conditions within the geographic area that includes lands west of the Sacramento Deep Water Ship Channel to its confluence with the Sacramento River; and lands east of (but not including) the Sacramento River south to its confluence with the Mokelumne River, east of the South Fork Mokelumne River south to White Slough, east of White Slough south its confluence with the San Joaquin River, and east of the San Joaquin River to Rough and Ready Island (Figure A.11.2).

- Tidal Freshwater Emergent Wetland
  - All *Scirpus* and *Typha*-dominated types.
- Nontidal Freshwater Permanent Emergent
  - Broad-leaf Cattail (*Typha latifolia*)
- Natural Seasonal Wetlands
  - *Distichlis spicata* Alliance
  - *Distichlis spicata*-Annual grasses Provisional
  - Seasonally flooded grasslands
- Managed Seasonal Wetlands
  - Rabbitsfoot grass (*Polypogon monspeliensis*)
  - Poison hemlock (*Conium maculatum*)
  - Intermittently flooded perennial forbs
  - Managed annual wetland vegetation (Non-specific grasses and forbs)
  - Seasonally-flooded undifferentiated annual grasses and forbs
  - Intermittently or temporarily flooded undifferentiated annual grasses and forbs
  - *Scirpus* spp. in managed wetlands
  - Smartweed – *Polygonumm* spp. – mixed forbs
  - *Polygonum amphibium* Provisional
  - *Lepidium latifolium* Alliance
- Valley Riparian
  - All *Salix*-dominated types except those that are inclusions within other riparian overstory types.

- Agriculture
  - Rice
  - Irrigated cropland adjoining Rice, Managed Wetland, Emergent Wetland, and *Salix*-dominated riparian
- Canals, sloughs, and permanent or intermittent streams (except the Sacramento and San Joaquin Rivers) that are internal to or within 8 km of patches of Rice, Managed Wetland, emergent Wetland, and *Salix*-dominated riparian.

Assumptions: Giant garter snakes inhabit marshes, ponds, sloughs, small lakes, low gradient streams, and other waterways, and agricultural wetlands, including irrigation and drainage canals, rice fields, and the adjacent uplands (USFWS 2006b). In the Sacramento Valley, their habitat requirements include: 1) adequate water during the snake's active season (early-spring through mid-fall) to provide food and cover; 2) emergent herbaceous wetland vegetation for escape cover and foraging habitat during the active season; 3) basking habitat of grassy banks and openings in waterside vegetation; and 4) higher elevation uplands for cover and refuge from flood waters during the snake's dormant season in the winter (USFWS 2006b).

Due to lack of habitat and emergent vegetative cover, giant garter snakes generally are not present in larger rivers with sand, rock, and gravel substrates (e.g., the Sacramento and San Joaquin Rivers). Riparian woodlands are unlikely to provide suitable habitat due to excessive shade, lack of basking sites, and absence of prey populations (USFWS 2006b). However, it is assumed that because of the relatively low overstory structure and intermittent occurrence, giant garter snakes could potentially occur along watercourses with *Salix*-dominated riparian habitats. Irrigated cropland adjoining rice, managed wetland, emergent wetland, and willow scrub are included as habitat because canals associated with irrigated cropland in close proximity to these other habitat types may also be used by giant garter snakes.

The giant garter snake has been observed to relocate to new resource patches during the breeding season and when threatened (Hansen pers comm.). Under extreme situations, the snake has been known to migrate up to 8 km along low gradient stream (natural and artificial waterways) corridors (Wylie pers.comm., Hansen pers. comm.). To address this potential movement, low gradient waterways that are hydrologically connected to identified breeding and movement habitat have been included as movement habitat. All streams internal to or within 8 km of identified breeding and movement habitat were classified as movement habitat.

Most recent occurrences of the giant garter in the planning area have been reported from outside of the Central Delta, including the Yolo Basin and along the eastern edge of the planning area from Stone Lake to the White Slough area (Caldoni Marsh). Two areas (Yolo Basin/Liberty Island and Caldoni Marsh) are included among the USFWS' 13 recognized extant populations (58 FR 54053). However, while recent findings demonstrate that giant garter snake is extant in the Yolo Basin (Hansen 2007, CNDDB 2008) repeated attempts to assess local distribution have not been successful and there is concern that these isolated populations may not be viable (Hansen pers. comm.). While surveys have not been conducted in over a decade, the population at Caldoni Marsh is considered extant.

Scattered records within the Central Delta suggest that giant garter snakes may have occupied this region at one time, but longstanding reclamation of wetlands for intense agricultural applications has eliminated most suitable habitat (Hansen 1986). Recent records within the Sacramento-San Joaquin Delta are sporadic, and repeated surveys have failed to identify any extant population clusters in the region (Hansen 1986, Patterson and Hansen 2002, Patterson

2003). There is also some speculation that recent occurrences in the Central Delta (e.g., Sherman Island) could be of snakes that occasionally move into the Central Delta from known populations, such as Caldoni Marsh, and that these occurrences do not represent local breeding populations (Hansen pers. comm.). Therefore, for purposes of this model, the Central Delta was excluded as potential habitat for the giant garter snake.

There are no known occurrences of giant garter snakes in the south Delta south of Stockton. This area is within the approximately 100 km gap that separates the northern and southern populations (Hansen and Brode 1980, 58 FR 54053).

A.11.8 Recovery Goals

The Draft Recovery Plan for the Giant Garter Snake was prepared in 1999 by the USFWS. The overall objective of this recovery plan is to delist the giant garter snake. The goals of the draft plan include: 1) stabilizing and protecting existing populations, and 2) conducting research necessary to further refine recovery criteria.

The plan lists the following conservation actions: 1) Protect existing populations and habitat, 2) Restore populations to former habitat, 3) Survey to determine species distributions, 4) Monitor populations, 5) Conduct necessary research, including studies on demographics, population genetics, and habitat use, and 6) Develop and implement incentive programs, and an outreach and education plan.

The recovery plan divided the Central Valley into four recovery units to aid in the recovery process. These units are 1) the Sacramento Valley Unit, extending from the vicinity of Red Bluff south to the confluence of the Sacramento and Feather Rivers; 2) the Mid-Valley Unit, extending from the American and Yolo basins south to Duck Slough near the City of Stockton; 3) the San Joaquin Valley Unit, extending south of Duck Slough to the Kings River; and 4) the South Valley Unit, extending south of the Kings River to the Kern River Basin.

Populations within the BDCP Planning Area are included in the Mid-Valley Unit. Recovery criteria for this unit are as follows:

a. Monitoring shows that in 17 out of 20 years, 90 percent of the subpopulations in the recovery unit (with the exception of the East Stockton – Diverting Canal and Duck Creek population) contain both adults and young.

b. The six existing populations within the recovery unit are protected from threats that limit populations.

c. Supporting habitat within the recovery unit is adaptively managed and monitored.

d. Subpopulations are well-connected by corridors of suitable habitat.

e. Repatriation has been successful at all suitable sites that had recently (within the last 10 years) extirpated populations.

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Personal Communication

Eric Hansen, Consulting Herpetologist. Phone conversation with Chris McColl (SAIC) on December 5, 2007. Phone conversation with Jim Estep on October 22, 2008.